Final Report

A project under the Canada
New Brunswick Conservation
and Renewable Energy
Demonstration Program

COLLEGE ST-LOUIS MAILLET
EDMUNDSTON

STUDENT'S RESIDENCE

HEAT SUPPLY SYSTEM CONVERSION FROM OIL TO SAWDUST

CREDA PROJECT #2021

February, 1985

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Canada/New Brunswick Conservation and Renewable Energy Demonstration Program

The Conservation and Renewable Energy Demonstration Program Program is administered in New Brunswick by the Energy Secretariat and managed jointly with Energy, Mines and Resources Canada. The Program is designed to help demonstrate promising conservation and renewable energy technologies, to develop public awareness and understanding of these technologies, and to create employment in new or existing industries.

Through over 100 demonstration projects in New Brunswick, a wide variety of conservation and renewable energy technologies have proven to be technically sound and economically attractive. These demonstration projects should now provide a catalyst for commercialization and lead to widespread adoption of many of these proven technologies.

This final report is based on a project which was financially supported by the Energy Demonstration Program. For further information on other demonstration projects funded in New Brunswick under this program, contact:

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Programme Canada/Nouveau-Brunswick de démonstration des économies d'énergie et des énergies renouvelables

Le Programme de démonstration des économies d'énergie et des énergies renouvelables est administré au Nouveau-Brunswick par le Secrétariat à l'énergie, en collaboration avec Energie, Mines et Ressources Canada. Ce programme tente d'abord de vérifier la fiabilité des techniques de conservation d'énergie, d'accroître la sensibilité du public envers ces techniques et, enfin, de favoriser la création d'emplois au sein des industries nouvelles ou déjà existantes.

Un grand nombre de projets de démonstration se sont avérés à la fois techniquement réalisables et économiquement attrayants.

Le succès ainsi rencontré encourage la commercialisation des procédés les plus accessibles. Cela entraînerait certes l'adoption d'un grand nombre de ces techniques par les propriétaires de domiciles et par l'industrie privée.

Ce rapport final est basé sur un projet qui a reçu une aide financière du Programme de démonstration. Pour de plus amples renseignements, communiquez avec la:

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D E N I D E R E S P O N S A B I L I T E

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1. EXECUTIVE SUMMARY

The Centre Universitaire Saint-Louis-Maillet campus is comprised of four buildings, three of which have been heated from a central heating plant with the use of sawdust since their construction. These buildings are:

1. Administration Building
2. Science Building
3. Library Building

The fourth building consisting mainly of the Co-Ed residence has been heated by an independent system fed with light fuel oil.

We felt that substantial savings could be achieved by converting the heat supply system at the residence from No. 2 fuel oil to sawdust.

This was accomplished by installing heat exchangers in the residence's existing boilers and branching this entire system directly to the existing central heating plant by insulated heat supply mains.

This demonstration project has been very successful. The use of non-renewable heating fuel has been totally eliminated while making full use of the existing sawdust boiler.

An energy saving of $32,040 has been achieved in the first year alone. This is a very significant saving and results in a short payback period of 1.4 years.

1. Sommaire Recommandation

Le Centre universitaire Saint-Louis-Maillet comprend quatre bâtiments, dont trois sont chauffés par un système central utilisant de la sciure de bois comme combustible depuis leur construction:

1. Le bâtiment administratif
2. Le bâtiment des sciences
3. Le bâtiment de la bibliothèque

Le quatrième bâtiment, qui sert principalement de résidence pour les étudiants, était chauffé par un système indépendant alimenté à l'huile légère.

Il semblait que des économies importantes pourraient être réalisées en convertissant à la sciure de bois l'appareil au mazout de la résidence.

Des échangeurs de chaleur furent donc installés dans les chaudières existantes de la résidence et ce système fut branché directement à la chaufferie centrale au moyen de conduites de chaleur isolées.

Ce projet de démonstration a connu beaucoup de succès. L'utilisation de combustible non renouvelable a été complètement éliminée en tirant profit au maximum du brûleur existant de sciure de bois.

Au cours de la première année seulement, on a réalisé des économies de $32 040. Il s'agit d'économies très importantes et le recouvrement ne nécessitera qu'une très courte période, soit 1,4 an.

2. INTRODUCTION AND BACKGROUND

The administration building was built in 1949. The library and science building were built in 1969. All of the three buildings have been very satisfactorily heated by the sawdust-fed heating plant. Also, it is to be noted that these buildings were connected by an elevated passageway.

In 1968, when fuel oil was selling for roughly 18¢ per gallon, a residence was built to house 165 students. It was to be a separate building from the other three and an independent heating system was installed.

The cost of heating fuel did not, however, remain this low. In fact from the mid-seventies the cost gradually increased to such a level that it prompted the administration to look at other heating alternatives for the residence.

In 1980, the authorities of College Saint-Louis initiated a feasibility study to determine alternate means of supplying heat to the Residence. The findings of the study were non-equivocal: use the existing sawdust-fed central heating system to supply heat to the residence.

The objective of the project was to demonstrate that through a very simple conversion of an existing fuel oil heating system to sawdust it was possible to achieve very substantial savings.

Considering the existence of the sawdust heating system for the other three buildings and the minimum work ano costs involved for incorporating the fourth building (residence) to that system, this was the only alternative considered.

The estimated savings in energy realized through this conversion, taking into account the heating fuel oil costs saved and the cost for the extra sawdust required, is approximately $32,000.00 annually.

Possible application for this technology would be any large institutional buildings requiring large amounts of energy for space heat. Typically, schools, hospitals, churches and others.

3. GENERAL DESCRIPTION OF THE DEMONSTRATION

The demonstration project consisted of four phases spread over a two month duration:

1. Excavation of approximately 300 linear feet and laying of 500 feet of 5" and 2" heat supply pipes, from the central sawdust boilers to the residence.

2. Installation of two heat exchangers for hot water and two heat exchangers for heating in the residence's existing system.

3. Connecting the pipes to the heat exchangers.

4. Connecting the pipes to the existing boilers.

4. OBSERVATIONS DURING INSTALLATION AND MONITORING

a) Installation

The installation of the heating conversion system for the residence has not encountered any particular difficulties. The construction and installation of the heating conversion system for the residence went as planned.

b) Monitoring

The system has been in operation since January 1982. The original calculations showed that the addition of the residence to the boilers would necessitate the regular use of the second boiler due to the maximum capacity of each. However, experience up to now has shown that it is only on extremely cold and windy days that the second boiler has to become operative. On regular winter days, only one boiler is sufficient. Hence, the addition of the residence on the central boilers load has not significantly changed the operation format of the boilers.

The monitoring of the central boilers is performed on a regular basis by our stationary engineer. From this monitoring and since the conversion of the residence's heating system to the central boilers, we are in a position to confirm that an average of 134 000 litres of heating fuel oil have been saved every year.

While on the other hand, the operation time of our central boilers have increased, but not significantly.

No particular problems or difficulties were encountered during this stage of the demonstration project, except for the normal system start-up bugs. Had we not had experienced personnel working in the central boiler room, these small start-up difficulties could have led to serious problems.

Our 35 years of experience at operating a sawdust boiler dictates that well experienced personnel are of the utmost importance. This is the one practical suggestion that we can make to any future installations. A good installation is important, but the operation and monitoring of the system is that much more important.

Included in the following table is a comparison of what the energy consumption for the residence was before and after the conversion of the heating system to the sawdust heating source.

ENERGY SAVINGS

	1980/81	1982/83
a) **Heating Fuel Oil** (annual)		
- Heating fuel oil consumed	134,000 litres	---
- Cost of fuel oil ($0.31/L)	$ 41,540	---
- BTU equivalent (30 000 BTU/L)	4×10^9 BTU	
b) **Sawdust** (annual)		
- Sawdust required to produce 4×10^9 BTU (8.3×10^6 BTU/ton)	---	500 tons
- Cost of sawdust ($19.00 Ton)	---	$9,500

c) **Savings from conversion** (annual) $41,540 - $9,500 = $32,040

NOTE

1. We have assumed that each litre of fuel oil will produce at 80% efficiency 30,000 BTU.

2. We have assumed that each pound of sawdust at 30% moisture will produce 4,160 BTU under an efficiency of 80%. Hence one ton will produce 8.3×10^6 BTU.

3. The annual consumption of heating fuel oil prior to the conversion did not vary very much from year to year. The average yearly consumption was 134,000 litres. By converting, this is what we are saving yearly in heating fuel oil.

5. COST/BENEFIT ANALYSIS

a) Project Costs

i) Construction

- Materials	$19,622.93
- Installation	$17,907.33
- Engineering	$ 2,223.46
SUB TOTAL	$39,753.72

ii) Information Transfer and Reporting $ 5,000.00

TOTAL FOR PROJECT $44,753.72

b) Project Financing

i) Energy Secretariat	$15,000.00
ii) Project Sponsor	$29,753.72
TOTAL	$44,753.72

c) Payback

An average $32,040 is saved each year due to the conversion of the residence's heating system to sawdust heat source. The cost for installing such a conversion system was $44,753.72 as mentioned above. Hence, the ratio between the costs of the installation and the annual savings gives us a payback period of 1.4 years.

6. CONCLUSIONS

It is well established that our demonstration project has been very successful, in the sense that the objective aimed for was attained. In fact, our original objective was to demonstrate that it was economically possible to use existing sawdust boilers to heat an existing fuel oil heated building. This was achieved, and more than reconfirmed that the 35 year old sawdust boilers are still very effecient energy saving devices.

Because the boilers use wood waste from the surrounding sawmills, they also help to protect the environment, and help to reduce the dependence of our country from non-renewable energy source, namely fuel oil.

Over 35 years of operating the heating system, much experience has been gained by our personnel in operating the sawdust boilers; and there is always more to learn. By incorporating the residence to the central heating system, we feel that this was a new challenge; and we were anxious to demonstrate that it could be economically met.

7. RECOMMENDATIONS

The few recommendations that we will make follow more or less the different aspects of the project as they were discussed in the preceeding paragraphs.

a) A feasibility study on the use of sawdust as an energy source should be made prior to making an actual implementation.

b) Such a study should, without being limited to, include the heating requirements, the source of supply of sawdust or wood residue, the physical aspect of the project, the costing, the financing, the savings, etc.....

c) It is worthwhile to make sure that the implementation of a sawdust boiler system over a reasonable time period pays for itself through the savings achieved.

d) Well experienced people are an important factor in the design, construction and operation phases of a sawdust boiler system.

e) From our experience, we have found that the boilers operate much more efficiently and trouble free when hardwood sawdust is used. Although hardwood sawdust has a higher BTU rating per pound than softwood, supply sources are limited. There is a significant amount of softwood sawdust not being used; it is just wasted. Hence, considerations should be given by any potential sawdust users to use as many varieties of wood waste as possible for heat production.

f) As mentioned earlier, we feel that a system such as this could be replicated by other institutions, commercial installations, and large buildings, provided a thorough analysis is made.

8. INFORMATION TRANSFER

After the completion of the project a press release was prepared and sent to all the New Brunswick newspapers.

During the summer months many interested parties visited our installation. These included people from the Regional Hospital, the N.B. Correctional Center, sawmill operators, etc.

On October 14, 1982, a one day seminar was organized. Presentations were made in both official languages, slides were shown on the different stages of the project and a site visit was also arranged with the aid of bilingual guides. A total of 42 persons attended the seminar.

A one page information pamphlet was prepared by Energy Secretariat and distributed.

9. SUPPORTING MATERIAL

You will find in the Appendices:

i) A breakdown of the cost incurred by the personnel at College St-Louis-Maillet for the information transfer and monitoring of the Demonstration Project.

ii) A sketch showing the location of the boiler room, the residence and the piping installed.

APPENDICES

MONITORING AND INFORMATION TRANSFER COSTS

1. Monitoring

The gathering of information under the monitoring was performed by our employees operating the boiler plant using the existing equipment and instruments. Through this information gathering we were able to determine how much more sawdust was burnt in order to supply heat to the residence, and hence eliminate completely the use of heating fuel oil for that building.

The estimated time spent by our employees and the cost incurred are summarized below:

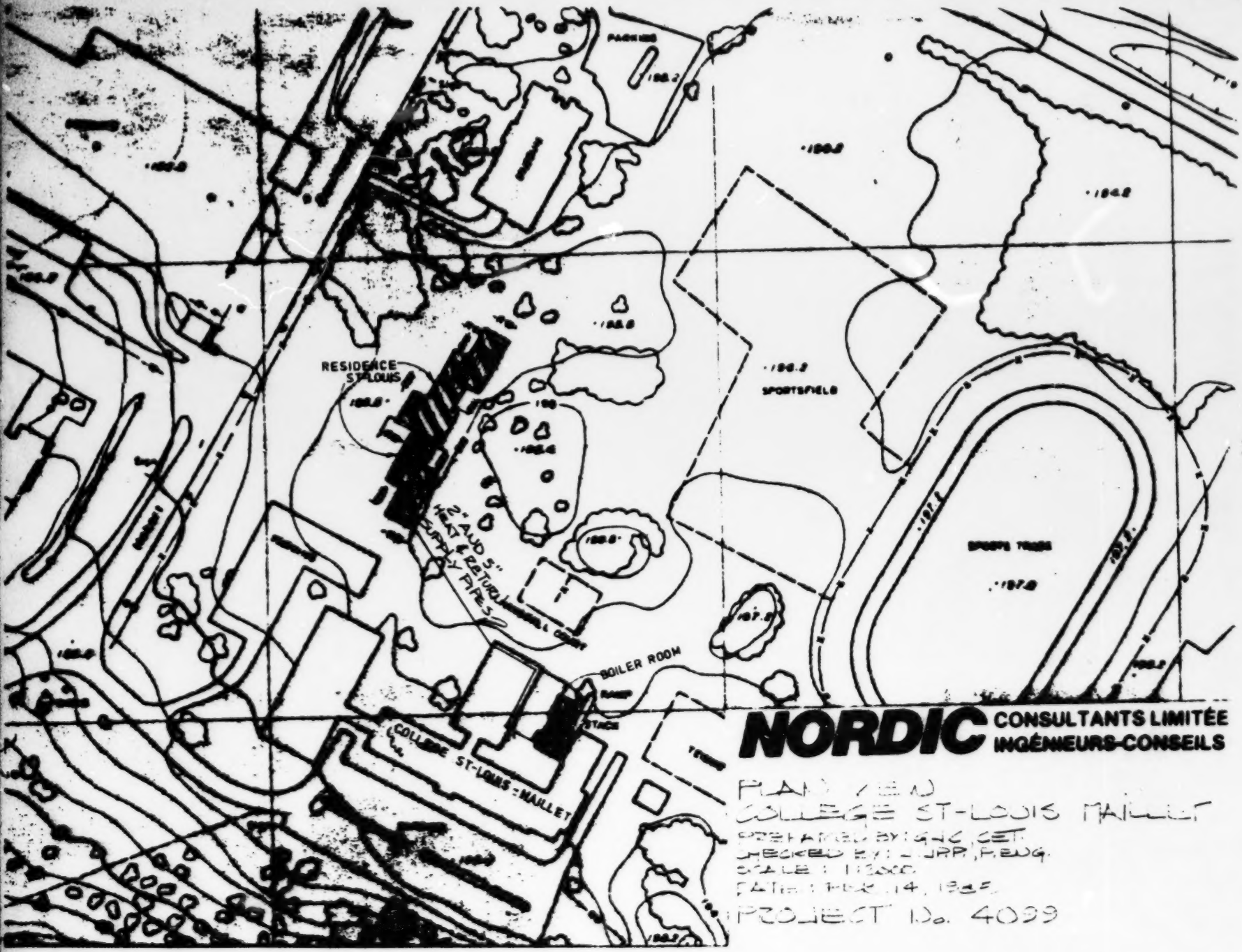
- Heating plant manager 30 hours @ $25.00/hour	$ 750.00
- Maintenance supervisor 70 hours @ $20.00/hour	$1,400.00
Monitoring Costs	$2,150.00

2. Information Transfer

Our heating plant is an attraction by itself; in fact we regularly receive visitors to view our boiler system and its operation.

Also, a one day seminar was held to introduce the project to the community. Costs for this open house are summarized below:

- Project Manager 50 hours @ $53.00/hour	$2,650.00
- Heating Plant Manager (Preparation of a paper & presentation)	$ 500.00
- Seminar Expenditures (already invoiced)	$ 303.52
Information Transfer Costs	$3,453.52



NORDIC CONSULTANTS LIMITÉE
INGÉNIEURS-CONSEILS

PLAN VIEW
COLLEGE ST-LOUIS MAILLET
DRAWN BY: G.N.C., C.E.T.
CHECKED BY: J.R.P., P.ENG.
SCALE: 1:1000
DATE: MAR. 14, 1985
PROJECT No. 4099